

1 **WHAT IS CLAIMED IS:**

- 2 1. An invert emulsion drilling fluid comprising
3 an oleaginous/continuous phase
4 a non-oleaginous discontinuous phase
5 a surfactant is a fatty acid ester of diglycerol or triglycerol, and
6 a weighting agent.
7
8 2. The invert emulsion drilling fluid of claim 1 wherein the surfactant is a di-fatty
9 acid ester of diglycerol and wherein fatty acid has the formula RCO_2H in which R is an
10 alkyl or akenyl having 10 to 20 carbon atoms.
11
12 3. The invert emulsion drilling fluid of claim 1 wherein the surfactant is a di-fatty
13 acid ester of triglycerol and wherein fatty acid has the formula RCO_2H in which R is an
14 alkyl or akenyl having 10 to 20 carbon atoms.
15
16 4. The drilling fluid of claim 1 wherein the oleaginous fluid is selected from diesel
17 oil, mineral oil, synthetic oil, ester oils, glycerides of fatty acids, aliphatic esters, aliphatic
18 ethers, aliphatic acetals, or other such hydrocarbons and combinations thereof.
19
20 5. The drilling fluid of claim 1 wherein the non-oleaginous phase is selected from
21 fresh water, sea water, brine, aqueous solutions containing water soluble organic salts,
22 water soluble alcohols or water soluble glycols or combinations thereof.
23
24 6. The drilling fluid of claim 1 wherein the weighting agent is a water soluble
25 weighting agent or a water insoluble weighting agent or combinations thereof.
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27 7. The drilling fluid of claim 6 wherein the water insoluble weighting agent is
28 selected from barite, calcite, mullite, gallena, manganese oxides, iron oxides, or
29 combinations thereof.
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- 1 8. The drilling fluid of claim 6 wherein the water soluble weighting agent is selected
2 from water soluble salts of zinc, iron, barium, calcium or combinations thereof.
3
4 9. The drilling fluid of claim 1 wherein the surfactant is selected from polyglyceryl-2
5 diisostearate or polyglyceryl-3 diisostearate.
6
7 10. An invert emulsion drilling fluid comprising
8 an oleaginous continuous phase
9 a non-oleaginous discontinuous phase,
10 a biodegradable surfactant including a di-fatty acid ester of diglycerol and wherein
11 fatty acid has the formula RCO_2H in which R is an alkyl or akenyl having 10 to 20 carbon
12 atoms, and
13 a weighting agent.
14
15 11. The drilling fluid of claim 10 wherein the surfactant is polyglyceryl-2
16 diisostearate.
17
18 12. An invert emulsion drilling fluid comprising
19 an oleaginous continuous phase
20 a non-oleaginous discontinuous phase,
21 a biodegradable surfactant including a di-fatty acid ester of triglycerol and
22 wherein fatty acid has the formula RCO_2H in which R is an alkyl or akenyl having 10 to
23 20 carbon atoms, and
24 a weighting agent.
25
26 13. The drilling fluid of claim 12 wherein the surfactant is polyglyceryl-3
27 diisostearate.
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29 14. A method of formulating an invert emulsion drilling fluid, said method
30 comprising:

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1 mixing an oleaginous fluid, a non-oleaginous fluid, a biodegradable surfactant and
2 a weighting agent, wherein the biodegradable surfactant includes a fatty acid ester of
3 diglycerol or triglycerol in amounts sufficient to form an invert emulsion in which the
4 oleaginous fluid is the continuous phase and the non-oleaginous fluid is the discontinuous
5 phase.

6
7 ~~15~~ 14. The method of claim 13 wherein the a fatty acid ester of diglycerol or triglycerol
8 is a di-fatty acid ester of diglycerol and wherein fatty acid has the formula RCO_2H in
9 which R is an alkyl or akenyl having 10 to 20 carbon atoms

10
11 ~~16~~ 15. The method of claim 13 wherein the a fatty acid ester of diglycerol or triglycerol
12 is a di-fatty acid ester of triglycerol and wherein fatty acid has the formula RCO_2H in
13 which R is an alkyl or akenyl having 10 to 20 carbon atoms

14
15 ~~17~~ 16. The method of claim 13 wherein the oleaginous fluid is selected from diesel oil,
16 mineral oil, synthetic oil, ester oils, glycerides of fatty acids, aliphatic esters, aliphatic
17 ethers, aliphatic acetals, or other such hydrocarbons and combinations thereof.

18
19 ~~18~~ 17. The method of claim 13 wherein the non-oleaginous phase is selected from fresh
20 water, sea water, brine, aqueous solutions containing water soluble organic salts, water
21 soluble alcohols or water soluble glycols or combinations thereof.

22
23 ~~19~~ 18. The method of claim 13 wherein the weighting agent is a water soluble weighting
24 agent or a water insoluble weighting agent or combinations thereof.

25
26 ~~20~~ 19. The method of claim 18 wherein the water insoluble weighting agent is selected
27 from barite, calcite, mullite, gallena, manganese oxides, iron oxides, or combinations
28 thereof.

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1 ²⁰ 20. The method of claim 18 wherein the water soluble weighting agent is selected
2 from water soluble salts of zinc, iron, barium, calcium or combinations thereof.

3 ²¹ 21. A method of drilling a subterranean hole with an invert emulsion drilling fluid,
4 said method comprising:
5

6 mixing an oleaginous fluid, a non-oleaginous fluid, a biodegradable surfactant,
7 and a weighting agent to form an invert emulsion, wherein the biodegradable surfactant
8 includes a fatty acid ester of diglycerol or triglycerol in amounts sufficient to form an
9 invert emulsion in which the oleaginous fluid is the continuous phase and the non-
10 oleaginous fluid is the discontinuous phase, and
11 drilling said subterranean hole using said invert emulsion as the drilling fluid.

12 ²² 22. The method of claim 20 wherein the a fatty acid ester of diglycerol or triglycerol
13 is a di-fatty acid ester of diglycerol and wherein fatty acid has the formula RCO_2H in
14 which R is an alkyl or akenyl having 10 to 20 carbon atoms.

15 ²³ 23. The method of claim 20 wherein the a fatty acid ester of diglycerol or triglycerol
16 is a di-fatty acid ester of triglycerol and wherein fatty acid has the formula RCO_2H in
17 which R is an alkyl or akenyl having 10 to 20 carbon atoms.

18 ²⁴ 24. The method of claim 20 wherein the oleaginous fluid is selected from diesel oil,
19 mineral oil, synthetic oil, ester oils, glycerides of fatty acids, aliphatic esters, aliphatic
20 ethers, aliphatic acetals, or other such hydrocarbons and combinations thereof.

21 ²⁵ 25. The method of claim 20 wherein the non-oleaginous phase is selected from fresh
22 water, sea water, brine, aqueous solutions containing water soluble organic salts, water
23 soluble alcohols or water soluble glycols or combinations thereof.

24 ²⁶ 26. The method of claim 20 wherein the weighting agent is a water soluble weighting
25 agent or a water insoluble weighting agent or combinations thereof.
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1 25
2 27. The method of claim 26 wherein the water insoluble weighting agent is selected
3 from barite, calcite, mullite, gallena, manganese oxides, iron oxides, or combinations
4 thereof.

5 29
6 28. The method of claim 26 wherein the water soluble weighting agent is selected
7 from water soluble salts of zinc, iron, barium, calcium or combinations thereof.

8 30
9 29. A method of drilling a subterranean well with an invert emulsion drilling fluid,
10 said method comprising:
11 mixing an oleaginous fluid, a non-oleaginous fluid, a biodegradable surfactant,
12 and a weighting agent to form an invert emulsion, wherein the biodegradable surfactant
13 includes a fatty acid ester of diglycerol, wherein the fatty acid has the formula RCO_2H in
14 which R is an alkyl or akenyl having 10 to 20 carbon atoms and wherein the
15 biodegradable surfactant is in amounts sufficient to form an invert emulsion in which the
16 oleaginous fluid is the continuous phase and the non-oleaginous fluid is the discontinuous
17 phase,

18 circulating said invert emulsion within said subterranean well and
19 drilling said subterranean well using said invert emulsion as the drilling fluid.

20 31
21 30. The method of claim 29 wherein the fatty acid ester of diglycerol is a di fatty acid
22 ester.

23 32
24 31. The method of claim 30 wherein the fatty acid ester of diglycerol is polyglyceryl-
25 2 diisostearate.

26 33
27 32. A method of drilling a subterranean well with an invert emulsion drilling fluid,
28 said method comprising:
29 mixing an oleaginous fluid, a non-oleaginous fluid, a biodegradable surfactant,
30 and a weighting agent to form an invert emulsion, wherein the biodegradable surfactant

1 includes a fatty acid ester of triglycerol, wherein the fatty acid has the formula RCO_2H in
2 which R is an alkyl or akenyl having 10 to 20 carbon atoms and wherein the
3 biodegradable surfactant is in amounts sufficient to form an invert emulsion in which the
4 oleaginous fluid is the continuous phase and the non-oleaginous fluid is the discontinuous
5 phase,

6 circulating said invert emulsion within said subterranean well and
7 drilling said subterranean well using said invert emulsion as the drilling fluid.

8 ~~34~~ ³³
9 ~~33~~ The method of claim ~~32~~ ³³ wherein the fatty acid ester of triglycerol is a di-fatty acid
10 ester.

11 ~~35~~ ³³
12 ~~34~~ The method of claim ~~32~~ ³³ wherein the fatty acid ester of triglycerol is polyglyceryl-
13 3 diisostearate.

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